AIR²
Access to INFRASTRUCTURES for Radiation protection Research

Issue 34
February 2019

Editorial

As we enter this new year, it is tempting to review the progress we have made since the start date of CONCERT in June 2015. We are now at the 34th issue of the AIR² newsletter and have more than 100 infrastructures listed in the AIR²D² database. We have committed to publishing 40 issues of AIR², and symbolically we want to stick to this number. The success of AIR² has led to the production of several special issues, the 4th of which is dedicated to the NASA infrastructures and is awaiting final validation, so should reach you very soon.

In 2019, there will not only be an internal review, which will undoubtedly bring self-satisfaction, but CONCERT has also been selected for project review by the Commission in March. Let's bet that we'll be able to increase the importance of the work carried out and the dynamics applied to promote the integration of radiation protection research.

Dr Laure Sabatier, CEA

The floor to...

STUK, the Finnish Radiation and Nuclear Safety Authority, supervises radiation and nuclear safety in Finland and conducts research in various areas of radiation protection. In addition, STUK is the expert body on emergency preparedness for nuclear and radiological emergencies. STUK's function is to protect people and society, the environment, and future generations from the harmful effects of radiation.

STUK – R&D to generate knowledge, tools and experts for supervision and emergency preparedness

In terms of strategy, one of STUK's main aims is to achieve an effective national radiation safety research programme. Radiation safety research generates experts, tools and knowledge needed for regulatory supervision and emergency preparedness. STUK's research is focussed in four key areas: Radiation and health, radiation in the environment, preparedness for radiation and nuclear threats and accidents, and measurements and technologies for radiation protection.

In collaboration with the Finnish universities, STUK has formed a National Research Consortium on Radiation Safety Research. Moreover a National Radiation Safety Research Programme has been created in order to determine research needs and ensure a high level of national competence in radiation safety research, and also to fulfil the information needs of national authorities.

STUK is a founding member of MELODI, NERIS and ALLIANCE, and is a member of EURADOS and an associated member of EURAMET. To date, STUK has participated in many European radiation protection-related projects. In the EJP CONCERT, STUK was mandated as Programme Manager by the Finnish Ministry of Health and Social Affairs, and participates in WP2, WP3, WP5 and WP6, as well as in the CONCERT-funded projects CONFIDENCE and TERRITORIES. STUK was previously the leader of WP2 before the lead was transferred to the University of Eastern Finland.

STUK serves as the national standards laboratory for radiation quantities, and maintains the metrological standards of radiation dose parameters. In addition, STUK is an accredited laboratory for radioactivity measurements. STUK's infrastructures for radiation protection research include facilities for gamma spectrometric and radiochemical analysis as well as for *in situ* and *in vivo* measurements.

Dr Maarit Muikku
STUK
CONCERT WP2, WP3, WP5, WP6, CONFIDENCE, TERRITORIES

Photo: STUK

CONCERT CORNER

Future events:

26-27 March 2019
CONCERT review meeting by the EC, Brussels

Call for Travel Grants
Next deadline: 31st March 2019
Information

14-18 October ERPW 2019
14th October: MB & ExB/ESAB

WP 6 News:

The first version of CONCERT's Web-handbook (D6.4) is now online!

AIR²D²:
- Please complete the online form(s) to register your infrastructure(s) in the database.

Follow STORE on Twitter: @STOREDatabase

Follow the TERRITORIES PROJECT BLOG https://territoriesweb.wordpress.com/

Contents:

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March 2019

This project has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 662287

The MIRCOM microbeam

Targeted ion irradiation of living biological samples

IRSN conducts research and development to better identify and to prevent side effects from the use of ionizing radiation for therapeutic purposes. To complete its experimental facilities dedicated to this research, IRSN has set up a platform named MIRCOM (Ion microbeam for the radiobiology of intra- and intercellular communications) enabling it to produce and use an ion microbeam.

Photo: IRSN

The MIRCOM building (700 m²) houses the microbeam line and a biology laboratory.

The main purpose of the MIRCOM platform is to study radiation-induced damage not only at DNA level but also at the level of intra- and intercellular communications. Its microbeam is capable of targeting cellular and subcellular elements to the nearest micrometer in order to irradiate them with a defined number of ions of a given energy.

The effects of this irradiation can then be directly observed by time-lapse imaging. The experimental irradiation conditions produced by MIRCOM are similar to those encountered in the medical field, especially with new radiotherapy techniques, but also in fields involving exposure to high energy radiation (particle accelerators, cosmic radiation, lasers, etc.) or α-emitting radioelements.

These specific characteristics mean that MIRCOM can also be used to explore specific problems associated with exposure to both low doses and high doses.

Photo: F. Vianna-Legros/IRSN

Dr F. Vianna-Legros

The MIRCOM platform is integrated in the AMANDE facility, which is France's national reference for neutron metrology in monoenergetic fields since 2005. This enables MIRCOM to use AMANDE's 2 MV Tandetron™ accelerator, which produces proton and deuteron beams in the 100 keV to 4 MeV range. Two new sources complete the facility, enabling the production of ions ranging from alpha particles (up to 6 MeV) to oxygen ions (up to 10 MeV). All these particles can be used to reproduce a wide range of situations involving the irradiation of cells and their constituents (exposure to the secondary particles generated when neutrons interact, to high energy radiation with biological media, to alpha-emitting radionuclides, etc.).

The platform also has a biology laboratory equipped with two cell culture rooms for preparing biological samples. All these features give the MIRCOM platform its unique characteristics.

MIRCOM was developed jointly within a collaboration between IRSN and the Centre for Nuclear Research at Bordeaux-Gradignan (CENBG), an establishment run by CNRS/IN2P3 and the University of Bordeaux. MIRCOM is open to research teams from the national and international scientific community, in the context of radiation protection research programmes.

ID Card:

Exposure type:
Horizontal ion microbeam (protons, alpha particles, B, C, O, ...)

Source:
2 MV Tandem accelerator

Dose rate:
From single ion irradiation to a few thousand ions per second

Irradiation type:
Targeted micro-irradiation

Irradiated organism type:
Cells, small multicellular organisms

Address:
IRSN/PSE-SANTE/SDOS/LMDN
B.P. 3
13115 Saint-Paul-Lez-Durance
France

Access:
Open to collaboration, selection committee

Supporting lab:
Cell culture labs, Biochemistry lab

Internet link:
https://www.irsn.fr/EN/Research/Scientific-tools/experimental-facilities-means/

Contact:
François Vianna-Legros
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Related to:
EURADOS
MELODI

Photo: F. Acerbis/IRSN

Panoramic view of the microbeam line

As the commissioning of this facility has started at the end of 2018, there is no article of reference available yet. The first publication about the performance of the microbeam is scheduled at the end of 2019.

The ISE cohort

Individual sensitivity to radiotherapy for breast cancer

In Germany, between 1998 and 2001, a total of 476 breast cancer patients aged 26-87 years were recruited to the ISE cohort following breast-conserving surgery and prior to adjuvant radiotherapy (RT). Patients who had received chemotherapy were not eligible. Radiotherapy was delivered to the whole breast 5x/week, at fractions of 1.8 or 2.0 Gy up to 50 Gy (or 56 Gy), with an additional boost (6-16 Gy) to the surgical site for most patients. Acute toxicity was assessed prospectively during and at the end of RT (ISE-1 study), and late toxicity was evaluated after a median time of 51 months (ISE-2 study: N=416) and 139 months (ISE-3 study: N=294).

ISE-1 study: Detailed documentation is available for acute side effects with an adapted CTC Score at 5 time points: Before RT, at 36 to 42 Gy, at 44 to 50 Gy, at end of RT, 6 weeks after RT.

Cancer treatment details in ISE-1	N	(%)
Hormone therapy	394	(82.8)
Radiotherapy (RT):		
Whole breast <50 Gy	13	(2.7)
Whole breast 50 - 50.4 Gy	426	(89.5)
Whole breast >50.4 - 56 Gy	37	(7.8)
No boost	48	(10.1)
Boost up to 10 Gy	238	(50.0)
Boost > 10 Gy	190	(39.9)
Interstitial boost	3	(0.6)
Boost range (Gy)	5 - 25	

Adapted CTC score:

0= No side effects
1= Faint or dull erythema; dry desquamation
2a= Tender or bright erythema; moderate oedema
2b= Severe erythema
2c= At least one moist desquamation or interruption of radiotherapy due to side effects
3= Several or confluent moist desquamation
4= Ulceration, hemorrhage, necrosis.

13% of the patients developed acute side effects grade 2c or 3.

Available **data and samples** from the ISE cohort:

In addition to evaluation of acute and late side effects by a study physician, detailed data was collected on the tumour, operation, treatment, medical history, lifestyle factors, quality of life (EORTC-QLQ-C30), fatigue, recurrence and second tumours. Genotype data is also available.

The primary **aim** of the prospective ISE study was to assess radiotherapy-related side effects. Thus the **study design** took into account the following considerations:

- Female patients who received radiotherapy after breast-conserving surgery for primary breast carcinoma: Objective evaluation of radiation therapy in the treated breast field compared to the untreated contralateral side to reduce interindividual differences, for example, age-related degenerative changes.

Photo: DKFZ

Prof. Jenny Chang-Claude

- Exclusion of the influence of chemotherapy on radiotherapy-related side effects.
- The follow-up examinations were conducted by a single physician to avoid any interexaminer differences.
- In follow-up examinations, the location of fibrosis was separately documented for fibrosis within and outside the surgical area. This reduces the risk of confounding late side effects of the radiation with side effects of the operation, such as wound healing and scar formation. It also enables a distinction to be made between high boost dose areas and lower dose areas.

Some selected **results** from the ISE 1-3 studies:

- For certain genotypes, the risk for acute toxicity may be higher with higher levels of oxidative stress (e.g. GSTP1).
- Age, acute skin toxicities and long term smoking increased the risk of teleangiectasia after 5 years.
- Polymorphisms near TNFalpha were associated with an increased risk for teleangiectasia.
- Using a radiation-induced lymphocyte assay (RILA), low values of $CD4^+$ T lymphocytes were found to be associated with an increased risk for fibrosis and teleangiectasia after 10 years.

Characteristics study population	ISE-1 (RT)		ISE-3 (139 months FU)	
	N=476	(%)	N=294	(%)
Age (years):				
26-49	51	(10.7)	1	(0.3)
50-69	342	(71.9)	124	(42.2)
70-91	83	(17.4)	169	(57.5)
Range	26 - 87		48 - 91	
Median	60		71	
BMI >25 kg/m²	230	(48.3)	150	(51.0)
Hypertension yes	152	(31.9)	144	(49.0)
LENT-SOMA Late toxicity scores:				
Teleangiectasia > 1cm² within OP area	--		26	(8.8)
Teleangiectasia > 1cm² outside OP area	--		11	(3.7)
Fibrosis score ≥ 2 within OP area	--		87	(29.6)
Fibrosis score ≥ 2 outside OP area	--		26	(8.8)
Quality of Life Questionnaire	457	(96.0)	294	(100)
Fatigue Assessment Questionnaire	--		293	(99.7)
Tumor contralateral side	6	(1.3)	4	(0.8)
Recurrence	--		22	(4.6)
Death due to breast cancer	--		32	(6.7)
Death due to other	--		39	(8.2)

ISE

ID Card:

Cohort type:
German cohort of 476 breast cancer patients who, after breast-conserving surgery, received adjuvant radiotherapy at a dose of 50-66 Gy. Detailed documentation on acute side effects during radiotherapy (ISE-1). Active follow-up after a mean of 51 (ISE-2) and 137 months (ISE-3) with assessment of vital status and radiotherapy-related toxicity of the skin and soft tissue.

Age:
- at exposure to radiotherapy (1998-2001): 26-87 years
- second follow-up (2011): 48-91 years

Biobank available:
Yes

Sample type:
DNA, RNA

Sample storage conditions:
-80°C

Access:
The database is owned by the DKFZ. Access to pseudonymised data and samples is subject to acceptance of a project proposal and signature of a material transfer agreement.

Internet link:
www.dkfz.de

Contact:
Prof. Jenny Chang-Claude
j.chang-claude@dkfz.de

Dr Petra Seibold
p.seibold@dkfz.de

+49-(0)6221-42-2200

Related to:
MELODI

Association of CD4+ radiation-induced lymphocyte apoptosis with fibrosis and telangiectasia after radiotherapy in 272 breast cancer patients with >10-year follow-up, Veldwijk M. R., Seibold P., Botma A., Helmbold I., Sperk E. et al. (2018), Clin Cancer Res, doi: 10.1158/1078-0432.CCR-18-0777
Predictive factors for late normal tissue complications following radiotherapy for breast cancer, Lilla C., Ambrosone C. B., Kropp S., Helmbold I., Schmezer P., von Fournier D., Haase W., Sautter-Bihl M. L., Wenz F., Chang-Claude J. (2007), Breast Cancer Res Treat, 106 (1), 143-150

The EFFTRAN code

Efficiency transfer and TCS corrections for γ-ray spectrometry

EFFTRAN is a freely available computer code for the calculation of efficiencies and true coincidence summing correction factors in gamma-ray spectrometry. It has an MS Excel-based user interface, with VBA providing a link to the computational routines written in FORTRAN. Installation is very straightforward and full source code is provided as part of the package.

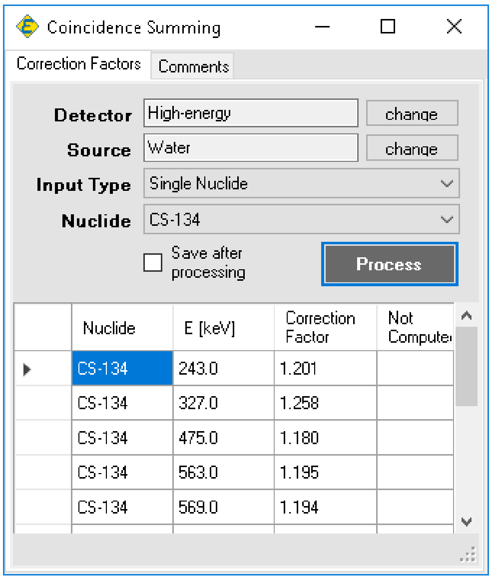

Photo: T. Vidmar/SCK•CEN

Calculation of coicindence summing correction factors with EFFTRAN.

In EFFTRAN, the efficiency transfer method is used for the calculation of efficiencies, and a calibration with a standard source is therefore required. The measured efficiency can then be transferred to a sample that differs from the standard, in size, composition and density. The computation of true coincidence summing correction factors does not require any measured data. However, with both methods, the parameters of a detector and source model need to be provided.

The coincidence library contains decay data on 300 radionuclides. True coincidence summing correction factors are provided for gamma rays, and gamma-gamma and gamma-X coincidences are taken into account.

Photo: T. Vidmar/SCK•CEN

Tim Vidmar

Calculations take only seconds to perform and can therefore be done routinely during the analysis of a measured spectrum. Materials can be defined as compounds and mixtures, and used for the construction of detector and source models.

Coaxial and planar detectors can be modelled, and the course types supported include cylindrical sources, point sources, filters and Marinelli beakers.

The code is primarily aimed at gamma-ray spectrometry laboratories that perform routine measurements and analysis of environmental samples. To date, the code has been used by some 300 such groups, many of whom are from developing countries.

Export and import of the efficiencies and the coincidence summing correction factors from Canberra's GENIE 2000 files and libraries is also provided.

EFFTRAN has been successfully validated and tested against similar codes of its kind and against experimental and synthetic data. Typical accuracy of the computed efficiencies and coincidence summing correction factors is a few percent. Its performance and algorithms have been described in several peer-reviewed articles published in international journals.

The code is available from the author upon request and completely free of charge.

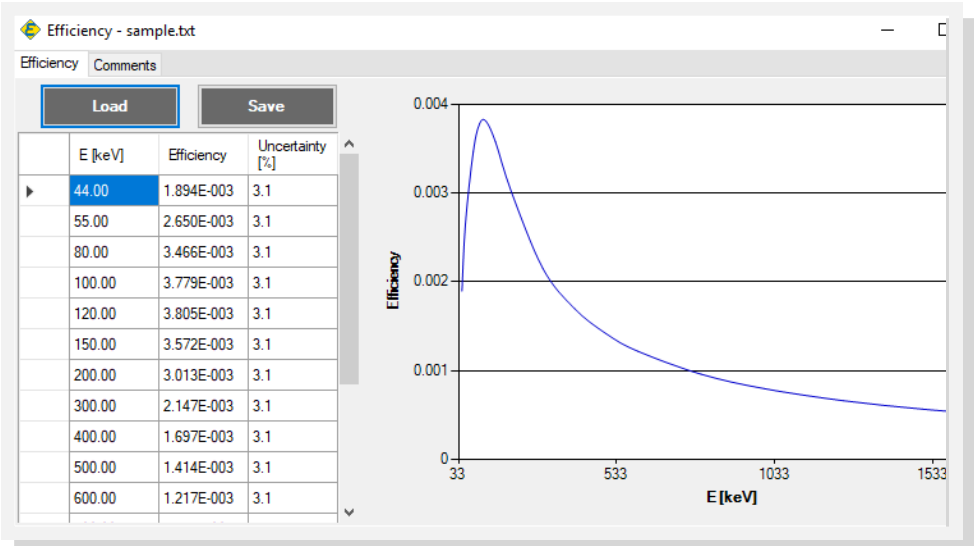

Photo: T. Vidmar/SCK•CEN

Displaying an efficiency curve in EFFTRAN.

ID Card:

Purpose:
Efficiency transfer and calculation of true coincidence summing correction factors in gamma-ray spectrometry

Capacity:
No limitations

Use:
Installation of a local copy; expertise in gamma-ray spectrometry required; user friendly interface

EFFTRAN can be accessed remotely from the user's own institute, if necessary with help from a specialist. It is easy to use for anyone with basic skills in the field

Housed on:
Local computer

Training proposed on the software:
EC- and IAEA- organised courses on gamma-ray spectrometry

Address:
SCK•CEN
Belgian Nuclear Research Centre
Boeretang 200
2400 Mol
Belgium

Access:
Freely available from the author upon request

Internet link:
www.efftran.com

Contact:
Tim Vidmar
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+32 14 33 21 10

Related to:
ALLIANCE

EFFTRAN - A Monte Carlo efficiency transfer code for gamma-ray spectrometry, Vidmar T. (2005), Nucl Instrum Methods Phys Res A, 550 (3), 603-608

Calculation of true coincidence summing corrections for extended sources with EFFTRAN, Vidmar T., Kanisch G., Vidmar G. (2011), Appl Radiat Isot, 69 (6), 908-911

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Access to INFRASTRUCTURES for Radiation protection Research

Issue	Exposure platforms	Databases, Sample banks, Cohorts	Analytical platforms, Models & Tools
Published to date:			
Oct 2015, #1	FIGARO	FREDERICA	RENEB
Nov 2015, #2	B3, Animal Contamination Facility	The Wismut Cohort and Biobank	The Hungarian Genomics Research Network
Dec 2015, #3	Pulex Cosmic Silence	STORE	METABOHUB
Feb 2016, #4	SNAKE	French Haemangioma Cohort and Biobank	Dose Estimate, CABAS, NETA
Mar 2016, #5	Radon exposure chamber	3-Generations exposure study	PROFI
Apr 2016, #6	Biological Irradiation Facility	Wildlife TransferDatabase	Radiobiology and immunology platform (CTU-FBME)
May2016, #7	CIRIL	Portuguese Tinea Capitis Cohort	LDRadStatsNet
Jun 2016, #8	Mixed alpha and X-ray exposure facility	Elfe Cohort	ERICA Tool
Jul 2016, #9	SCRS-GIG	RES³T	CROM-8
Sep 2016, #10	Facility radionuclides availability, transfer and migration	INWORKS cohort	France Génomique
Oct 2016 #11	LIBIS gamma low dose rate facility ISS	JANUS	Transcriptomics platform SCKCEN
Nov 2016, #12	Microtron laboratory	EPI-CT Scan cohort	CATI
Dec 2016, #13	Nanoparticle Inhalation Facility	UEF Biobanking	The Analytical Platform of the PREPARE project
Feb 2017, #14	Infrastructure for retrospective radon & thoron dosimetry	Chernobyl Tissue Bank	HZDR Radioanalytical Laboratories
Special Issue 1	1st CONCERT Call: CONFIDENCE, LDLensRad, TERRITORIES	1st CONCERT Call: CONFIDENCE, LDLensRad, TERRITORIES	1st CONCERT Call: CONFIDENCE, LDLensRad, TERRITORIES
Mar 2017, #15	Alpha Particles Irradiator Calibration Laboratory at KIT		SYMBIOSE
Apr 2017, #16	Changing Dose rate (SU) Low dose rate (SU)		Advanced Technologies Network Center
May 2017, #17	Chernobyl Exclusion Zone	Chernobyl clean-up workers from Latvia	BfS whole and partial body Counting
Jun 2017, #18	MELAF	Belgian Soil Collection	INFRAFONTIER
Jul 2017, #19	MICADO'LAB	Estchern Cohort	ECORITME
Sep 2017, #20	DOS NDS		CERES

Future events:

CONCERT Short Courses

11-22 February 2019

Two-week training course on radiation-induced effects with particular emphasis on genetics, development, teratology, cognition, cancer as well as space-related health issues, SCK•CEN, Belgium

Contact:
Sarah Baatout
sbaatout@sckcen.be

Registration deadline:
18 January 2019

18-22 February 2019

Emergency and recovery preparedness and response. National Center of Radiobiology and Radiation Protection, Bulgaria

Contact:
Nina Chobanova
n.chobanova@ncrrp.org

Registration deadline:
20 January 2019

11-15 March 2019

Radiation Protection: Basics and Applications. Forschungszentrum Jülich, Germany

Contact:
Ralf Kriehuber
r.kriehuber@fz-juelich.de

Registration deadline:
11 December 2018

15-19 April 2019

EURADOS-CONCERT School on uncertainty in biological, physical, and internal dosimetry following a single exposure. Institut de radioprotection et de sûreté nucléaire (IRSN), France

Contact:
Sophie Ancelet
sophie.ancelet@irsn.fr

Registration deadline:
15 February 2019

23 April-3 May 2019

Assessment of long-term radiological risks from environmental releases. Technical University of Denmark, Risø Campus, Denmark

Contact:
Kasper Andersson
kgan@dtu.dk

Registration deadline:
15 January 2019

See also on CONCERT website

Editorial Committee: Maria Panagiotopoulou, Jean-Michel Dolo, Elisabeth May, Laure Sabatier

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Access to INFRASTRUCTURES for Radiation protection Research

Issue	Exposure platforms	Databases, Sample banks, Cohorts	Analytical platforms, Models & Tools
Published to date:			
Oct 2017, #21	CALLAB Radon Calibration Laboratory		CORIF
Nov 2017, #22	Calibration and Dosimetry Laboratory (INTE-UPC)	German airline crew cohort	Centre for Omic Sciences (COS)
Dec 2017, #23	NMG	Techa River Cohort (TRC)	iGE3
Special Issue 2	MEDIRAD	MEDIRAD	MEDIRAD
Feb 2018, #24	UNIPI-AmBe	Greek interventional cardiologists cohort	SNAP
Special Issue 3	2nd CONCERT Call: LEU-TRACK, PODIUM, SEPARATE, VERIDIC, ENGAGE, SHAMISEN-SINGS	2nd CONCERT Call: LEU-TRACK, PODIUM, SEPARATE, VERIDIC, ENGAGE, SHAMISEN-SINGS	2nd CONCERT Call: LEU-TRACK, PODIUM, SEPARATE, VERIDIC, ENGAGE, SHAMISEN-SINGS
Mar 2018, #25	IRRAD	MARiS	BIANCA
Apr 2018, #26	Forest observatory site in Yamakiya	BBM	OEDIPE
May 2018, #27	Belgian NORM Observatory Site	The German Thorotrast Cohort Study	VIB Proteomics Core
Jun 2018, #28	CERF	Mayak PA worker cohort	Geant4-DNA
Jul 2018, #29	TIFPA	RHRTR	D-DAT
Sep 2018, #30	HIT	The TRACY cohort	COOLER
Oct 2018, #31	PTB Microbeam	The BRIDE platform	BRENDA
Nov 2018, #32	AGOR Facility at KVI-CART LNK		MARS beamline at SOLEIL
Dec 2018, #33	PARISII	The ISIBELa cohort	CIEMAT WBC
Feb 2019, #34	The MIRCOM microbeam	The ISE cohort	EFFTRAN

Future events:

Other Events

11-14 February 2019
EURADOS Annual Meeting 2019, Łódź, Poland

21-22 February 2019
Environmental Epigenetics Workshop - From Mechanisms to Regulation, Örebro, Sweden

5-6 March 2019
NUCL-EU 2020 EURATOM – Horizon 2020 Training on Proposal preparation, Technology Centre CAS, Prague, Czech Republic

25-28 March 2019
TRANSAT:
First Tritium School, Ljubljana, Slovenia

25-29 March 2019
EURADOS Training Course on Technical Recommendations for Monitoring Individuals for Occupational Intakes of Radionuclides, IAEA, Vienna, Austria
Contact:
Bastian Breustedt
Bastian.breustedt@kit.edu

3-5 April 2019
5th NERIS Workshop & 10th General Assembly, Roskilde, Denmark

10-12 April 2019
8th EUTERP Workshop 2019 : Optimizing radiation protection training, Qawra, St. Paul's Bay, Malta

13-16 May 2019
ConRad 2019, Munich, Germany

13-16 May 2019
Confidence training course
Use of uncertain information by decision makers at the various levels within the decision making process and its Communication, VUJE, Trnava, Slovak Republic

10-14 June 2019
Seventh International Conference on Radiation in Various Fields of Research (RAD 2019), Herceg Novi, Montenegro

27-31 May 2019
ICDA-3:
3rd International Conference on Dosimetry, Lisbon, Portugal

25-29 August 2019
ICRR 2019: 16th International Congress of Radiation Research, Manchester, UK

16-20 September 2019
RADECS 2019: Radiation and its Effects on Components and Systems, Montpellier, France

Editorial Committee: Maria Panagiotopoulou, Jean-Michel Dolo, Elisabeth May, Laure Sabatier